Answer Scheme for Sec 4E Biology Prelims P1 & P2 2024, St Gabriel's Secondary School

Paper 1

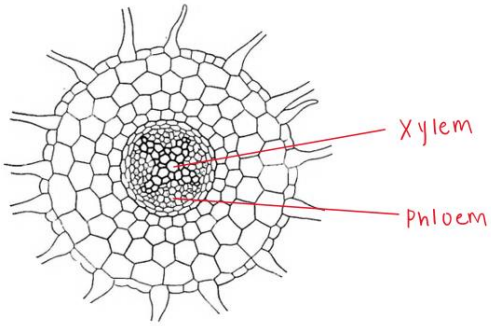
1	2	3	4	5	6	7	8	9	10
A	**D**	**C**	**D**	**A**	**B**	**B**	**B**	**B**	**D**
11	12	13	14	15	16	17	18	19	20
B	**D**	**C**	**B**	**A**	**D**	**A**	**C**	**B**	**A**
21	22	23	24	25	26	27	28	29	30
C	**C**	**A**	**D**	**B**	**A**	**B**	**C**	**C**	**B**
31	32	33	34	35	36	37	38	39	40
D	**A**	**C**	**A**	**D**	**B**	**C**	**A**	**C**	**D**

A: 10 **B**: 11 **C**: 10 **D**: 9

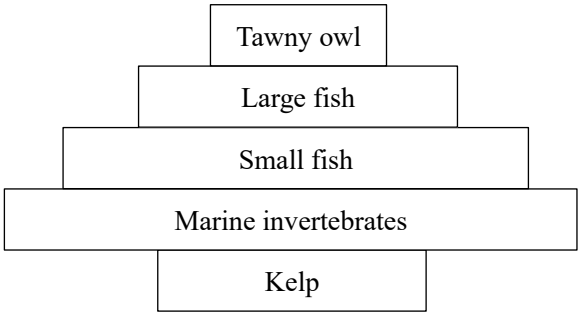
Paper 2 Section A

No.	Answer	Remarks
1 (a)	• Between 650 and 900 cells per ml	1
1 (b)	• [D1] From the 2nd to the 4th hour, the concentration of Campylobacter protein decreased from 800 cells per ml to about 220 cells per ml, by about 580 cells per ml • [D2a] From the 2nd to the 3rd hour, the concentration of Campylobacter protein decreased steeply from 800 cells per ml to about 420 cells per ml, by about 380 cells per ml • [D2b] From the 3nd to the 4th hour, the concentration of Campylobacter protein decreased less steeply from 420 cells per ml to about 220 cells per ml, by about 200 cells per ml • [E1] Antibiotics <u>kill / inhibit bacteria growth</u> by interfering with bacterial growth & metabolic activities, • [E2] such as <u>inhibiting cell wall synthesis / cell membrane function / protein synthesis in ribosomes / enzyme action in cytoplasm</u> hence concentration of Campylobacter protein decreased • [E3] <u>Time is needed</u> for digestion of coating / absorption / transport to area of effect, hence <u>takes 2-4 hours for effect to show</u> (max 4)	4

1 (c)	Any 2: • Cell wall • Cell membrane • (free) ribosome • flagellum • circular DNA • plasmid	**R** DNA / genetic material 2
1 (d)i	• <u>Yes, Infectious diseases</u> can be <u>spread from person to person</u> • Campylobacter spreads by <u>contaminated food</u> / ORA	2
1 (d)ii	• A vaccine contains an agent that resembles Campylobacter • White blood cells binds to antigens on vaccine • Some white blood cells remain in the blood stream for a long time as memory cells. • In the future, when the Campylobacter enters the body, memory cells recognise the pathogen • produce the antibodies to destroy it (max 3)	3

2	• Wilting occurs when rate of water loss by transpiration exceeds rate of water gained from roots • Thin / small leaves reduces surface area to volume ratio • Less water loss by transpiration • Reduces chances of rate of water loss by transpiration exceeding rate of water gained from roots / OWTTE	2
2 (b)	 • Correct xylem label (lignified vessels) • Correct phloem label (non-lignified vessels in the core)	2
2 (c)	• M: oxygen; photosynthesis • P: carbon dioxide; respiration	2
2 (d)	• active transport require energy from aerobic respiration. • Root is mostly submerge in water, where there is low concentration / level of dissolved oxygen in water available for aerobic respiration.	2

3a	• Blocked vessel: Coronary artery • Vessel A: Aorta	2
3b	• less oxygen and glucose delivered to heart muscles leads to reduced rate of aerobic respiration • Heart muscle cells die leading to heart attack	2
3c	• Thinner muscular walls hence less able to withstand high pressure ; • Presence of valves, hence blood travel slower/ impede blood flow ; • Less elastic fibre / tissue hence less able to stretch and recoil; • Large lumen relative to diameter, hence speed of blood slows down (any 2)	2 **R** small walls, thin without mentioning about the walls ; treated as foreign body and rejected by immune system
3di	• Fat deposit / cholesterol	1
3dii	• Anti-platelets drug administered to prevents platelet release, prevents soluble fibrinogen to change to insoluble fibrin ; • prevents blood to clot due to damage or injury caused by insertion of the stent • prevents blood vessel to be further narrowed (any 2)	2 **R** prevents agglutination

4ai	 • Correct Shape • Correct Order of organisms	
4aii	• About 90% of energy is lost at each trophic level / when transferred from one trophic level to another; • through processes like heat loss during respiration, faeces egestion, uneaten body parts, and excreted substances like urea/ carbon dioxide (any 2 stated)	
4bi	• Number of light grey owls increase; • as light grey owls camouflage better than brown tawny owls; • light grey owls selected for / have selective advantage over brown tawny owls • Less light grey owls eaten; • More light grey owls survive to reproduce / becomes a reproductive adult • More light grey owls survive to pass on genes/alleles for brown coats to offspring; (max 3)	3
4bii	Combustion of fossils/ deforestation/any activities that increase the release of carbon dioxide into atmosphere or destroy carbon sink (any 2)	2
4c	• Decreased northern goshawk population will increase tawny owl population, due to presence of less predators, and decreases large fish population due to presence of more predators (at least 2 trophic levels mentioned correctly) • Decreased northern goshawk population disrupts balance of ecosystem / biodiversity / every trophic level downstream in the food chain / OWTTE	1

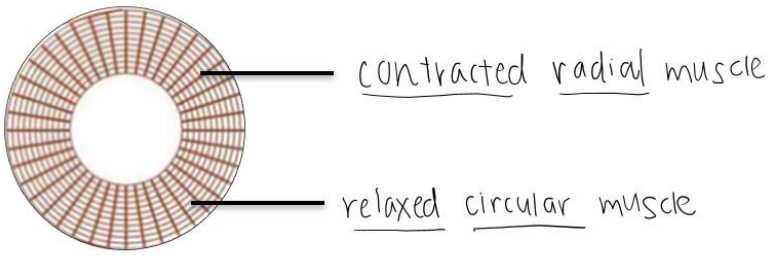
<table>
<tr><td>5a</td><td>• Aerobic respiration is the breakdown of glucose to release energy in the presence of oxygen.</td><td>1</td></tr>
<tr><td>5b</td><td>• During exercise, muscles contract vigorously, requiring energy.
• Muscle cells then carry out anaerobic respiration, producing lactic acid.
• Lactic acid accumulates in the muscles, causing soreness and fatigue. The body now incurs an oxygen debt.

(max 2)

• Heart rate remains high to maintain fast transport of
• lactic acid from muscles to liver and oxygen from lungs to liver
• Deeper and faster breathing allows continuously fast oxygen uptake
• In the liver, oxygen is required to remove lactic acid
• In the liver, lactic acid is also converted to glucose
• When all lactic acid is converted to glucose, oxygen debt is repaid.</td><td>4</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>5c</td><td>
<table>
<tr><th>Chemical</th><th>electronic cigarettes</th><th>traditional tobacco smoke</th></tr>
<tr><td>Nicotine [1]</td><td colspan="2">• Both electronic cigarettes and traditional tobacco smoke contain nicotine that is an addictive drug that releases adrenaline [1]
• increases heart rate and blood pressure / Makes blood clot/ narrows artery lumen easily, increasing risk of coronary diseases / affects fetal development, increase risk of miscarriage [1]</td></tr>
<tr><td>Tar [1]</td><td colspan="2">• Both electronic cigarettes and traditional tobacco smoke have carcinogenic / cancer - causing effects [1]
• due to fumes from the vaporisation of the electronic cigarettes liquids and tar in traditional tobacco smoke [1]

• Both electronic cigarettes and traditional tobacco smoke causes inflammation [1]
• due to propylene glycol in electronic cigarettes liquids and tar and irritants in traditional tobacco smoke [1]
• that paralyses cilia lining the air passages causing inflammation from the dust-trapped mucus in the air passages [1]</td></tr>
</table>
(any 5)
</td><td>5</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

6a	• When the blood glucose concentration becomes above threshold level / normal set point, • the cells in pancreas' islets of Langerhans are stimulated • to secrete insulin into the bloodstream, to be transported to liver and muscle cells • At the liver and muscle cells, insulin causes cell membranes to be more permeable to glucose, so glucose uptake increases from the bloodstream to the cells • Insulin stimulates conversion of glucose to glycogen to be stored in the liver/ muscle cells • insulin stimulates increased respiration rate to oxidise more glucose • Blood glucose concentration then decreases to threshold level / normal set point (max 4)	4
6b	• Age/ height and mass/ proportion of males and females or group size/(same) severity of diabetes/ (same) activity (during investigation)/ (same) type of meal/ dose of drug/ (similar) blood glucose concentrations at start/ other health conditions or other drugs being taken;	1
6c	• **Bar graph** drawn • **Axes** drawn • Correct **y-values** • Equal **width** for bars and Equal width for separators;	4
	Disagree with statement • (Tzield + A), 305 mg / 100 cm^3, gives lower (%) reduction (in blood glucose) than Tzield alone, 277 mg / 100 cm^3 + so statement is not supported; • (Tzield + B), 306 mg / 100 cm^3, gives lower (%) reduction (in blood glucose) than Tzield alone, 277 mg / 100 cm^3 + so statement is not supported; • number of people used, 220, is not very large; • number of people in each group is different (at least 2 group data quoted); (any 2)	2

7a	• The Nervous System: consists of brain, spinal cord, and nerves to co-ordinate and regulate bodily functions	1
7b	• A reflex action is an immediate response • to a specific stimulus without conscious control.	2
7ci	(circular and radial muscles of the) iris	1
7cii		2 1m for each correctly labelled muscle
7d	• The ciliary muscles controls the curvature or thickness of the lens • When ciliary muscles are paralysed, ciliary muscles cannot contract, Suspenso ligaments cannot slacken • Lens remain thin and less convex / cannot become thicker and more convex • Focal length remains long / cannot decrease • This causes one to have blurred / unfocused vision when looking at near object (max 3)	3

Paper 2 Section B

8a	• Fresh water has a higher water potential than animal cell. • Net movement of water molecules from outside cell into the cell by osmosis • Cells swell / increase in size + Without cell wall, the cell will burst. Therefore, it needs to remove excess water.	3
8b	• Osmosis is not involved as osmosis requires water molecules to pass through a partially permeable membrane but water molecules do not pass through a partially permeable membrane in the removal shown in Figure 8.1.	1
8c	• [D1] When concentration of sea water is at 0%, the rate of water excreted is at 17.2 $\mu m^3/s$. • [D2] When sea water concentration increases to 4%, rate of water excreted decreased to 10.4 $\mu m^3/s$, by 6.8 $\mu m^3/s$ • [D3] When sea water concentration increases to 12%, rate of water excreted decreased to 0.4 μm3/s, , by 10.0 $\mu m^3/s$ • [E1] This is because as concentration of sea water increases, the water potential gradient decreases / becomes less steep / more gentle. • [E2] Less water enters the cell + less excess water needs to be excreted (D: max 2)	3
8d	Ethanol emulsion test procedure: 1. Add 2 cm^3 of ethanol to 2 cm^3 of membrane. 2. Decant solution / mixture into a test tube with 2 cm^3 water. 3 Shake the tube vigorously	3

9a	Sexual reproduction is the process involving: • the fusion of a male gamete's haploid nucleus and a female gamete's haploid nucleus to form a diploid zygote • and produce genetically dissimilar offspring	2
9bi	• Stage 3: ovulation • Dates: 11 May - 16 May (Day 14: 15 May; fertile period: Days 10-15)	2
9bii	• there is a natural variation in the length of menstrual cycle, / OWTTE • different women have varying number of days in each cycle / OWTTE (max 1)	1
9c	• ovulation stimulates progesterone production, • high progesterone levels in stage 4 / after stage 3 • which maintains uterine lining to be thick and spongy • preventing breaking down of uterine lining (max 2)	2
9d	father x mother genotypes of parents Nn Nn gametes N n N n genotypes of offspring NN Nn Nn nn	3 1 1 1

Symbols used in mark scheme and guidance notes.

/	separates alternatives for a marking point
;	separates points for the award of a mark
B.O.D	Benefit Of Doubt
ORA	or reverse argument / reasoning
OWTTE	or words to that effect
E.C.F	Error Carried Forward
A	accept - as a correct response
R	reject – this is marked with a cross and any following correct statements do not gain any marks
I	ignore / irrelevant / inadequate – this response gains no mark, but any following correct answers can gain marks.
( )	the word / phrase in brackets is not required to gain marks but sets the context of the response for credit. e.g. (waxy) cuticle. Waxy not needed but if it was described as a cellulose cuticle then no mark is awarded.

END OF MS